Brittle vs. Ductile Rocks

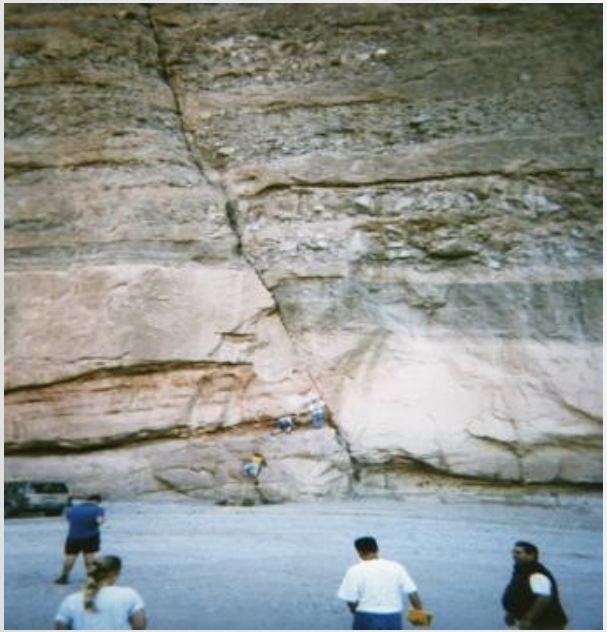
Big Hunk™ as an analog

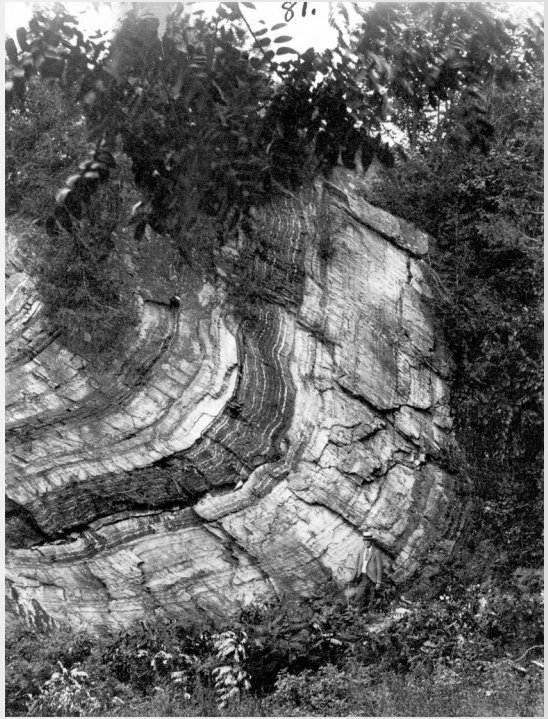
for rock behavior

Developed by Dr. Robert Butler
University of Portland, OR

Evidence

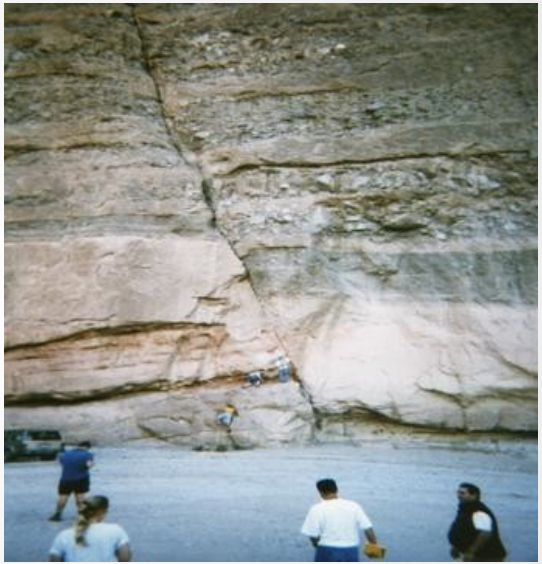
What has occurred in these two images?
What is your evidence?



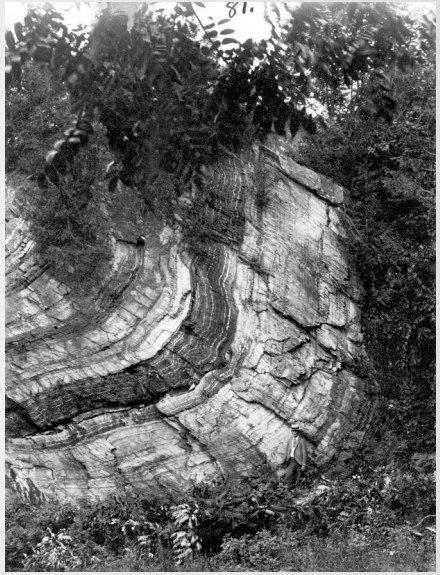


Evidence

The image on the left shows that the layers on one side of the large crack have been displaced relative to the layers on the other side. This suggests that the rock was not relatively warm when the stress was applied to it and as a result it fractured.

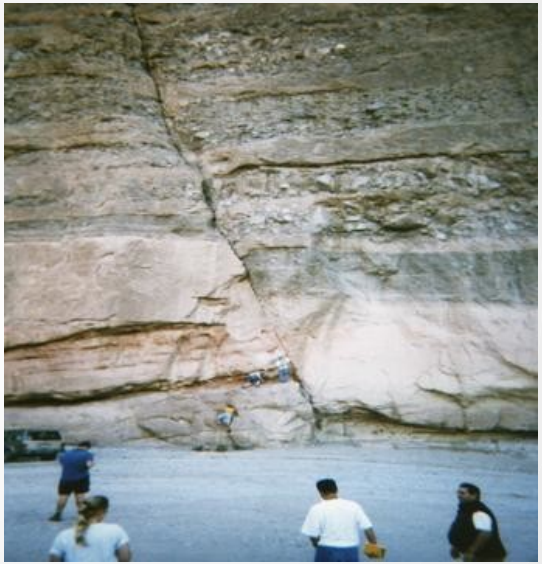


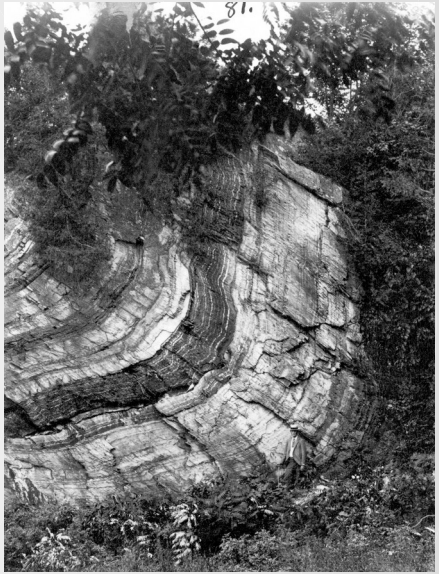
Conversely the image on the right shows “folding” but no offset of the layers. This suggests that these rocks were warm and ductile, not



Evidence

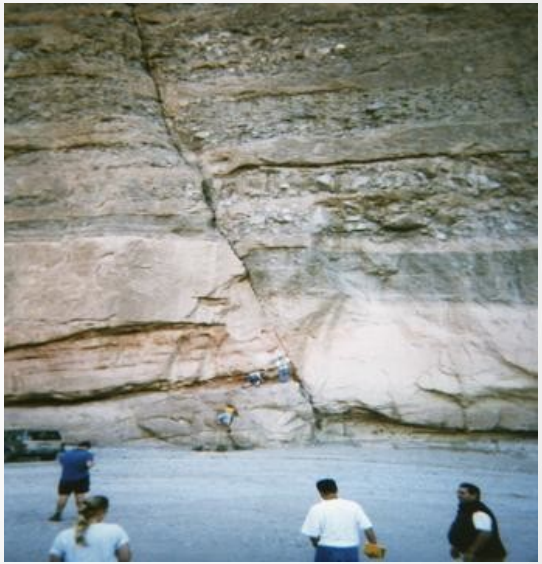
Which of these two situations would be most likely to have caused an earthquake?

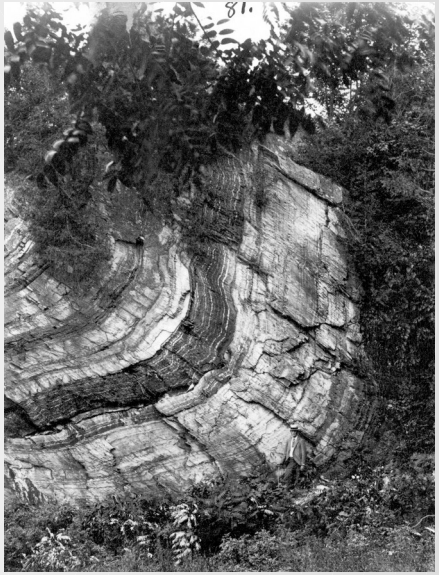




Evidence

The image on the left is a fault or a fracture in brittle rock. The block of rock on one side has moved relative to block of rock on the other side. This fracturing of the rock produces an earthquake, or the sudden release of energy that has accumulated elastically in the rock over a long period of time.



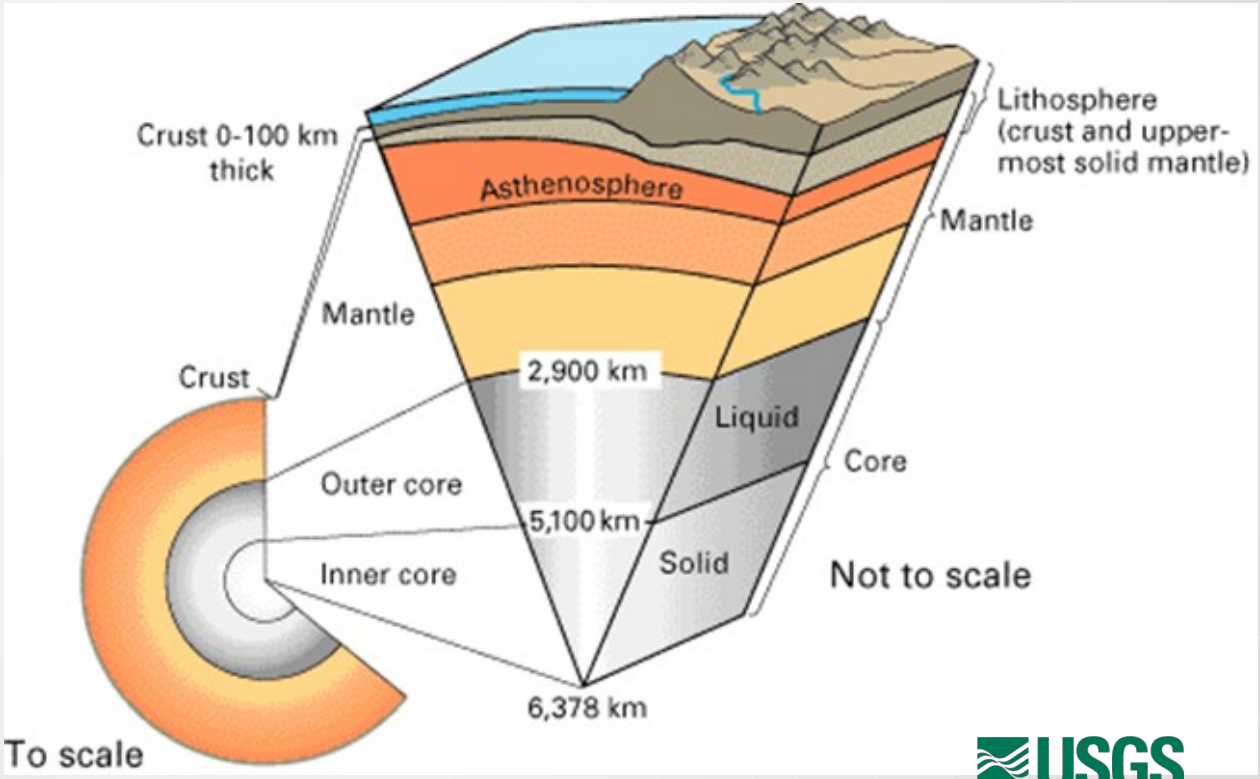


The image on the right shows a fold in the rock layers. Folds form when rocks bend or undergo ductile deformation over a prolonged period of stress.

Where do earthquakes occur?

Most earthquakes occur occur within 50km of Earth's surface but some can occur as deep as 300km in subduction zones.

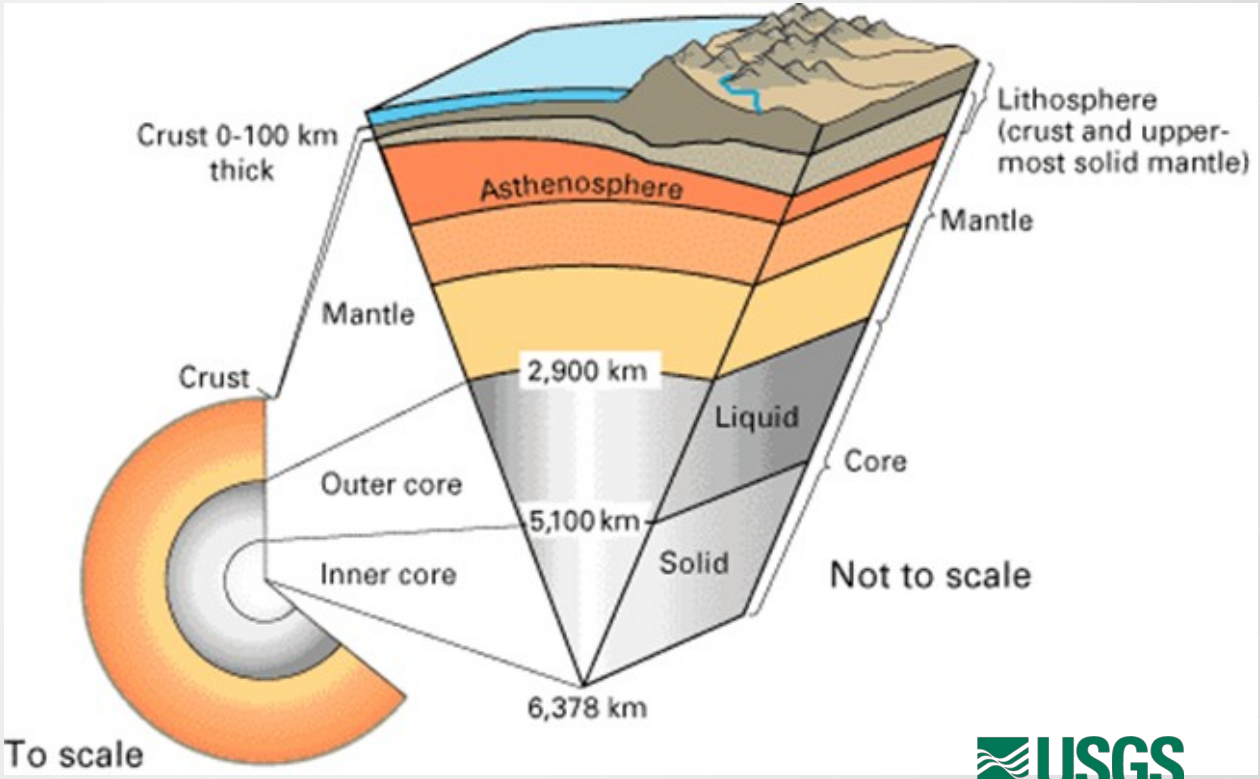
QUESTION:
Why don't earthquakes occur below these points?



Where do earthquakes occur?

ANSWER:

Below ~50km depth, the confining pressure and temperature of Earth becomes so great that they inhibit nearly all fractures from forming.



Graphing T and P

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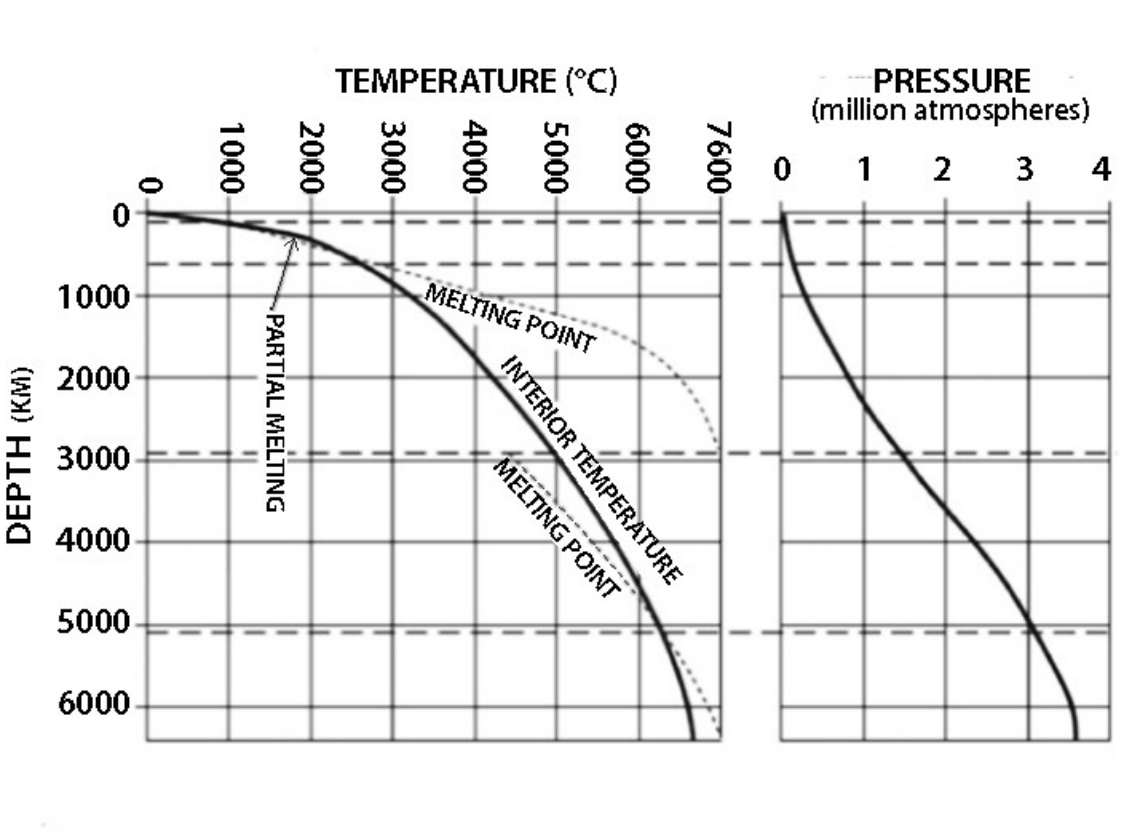

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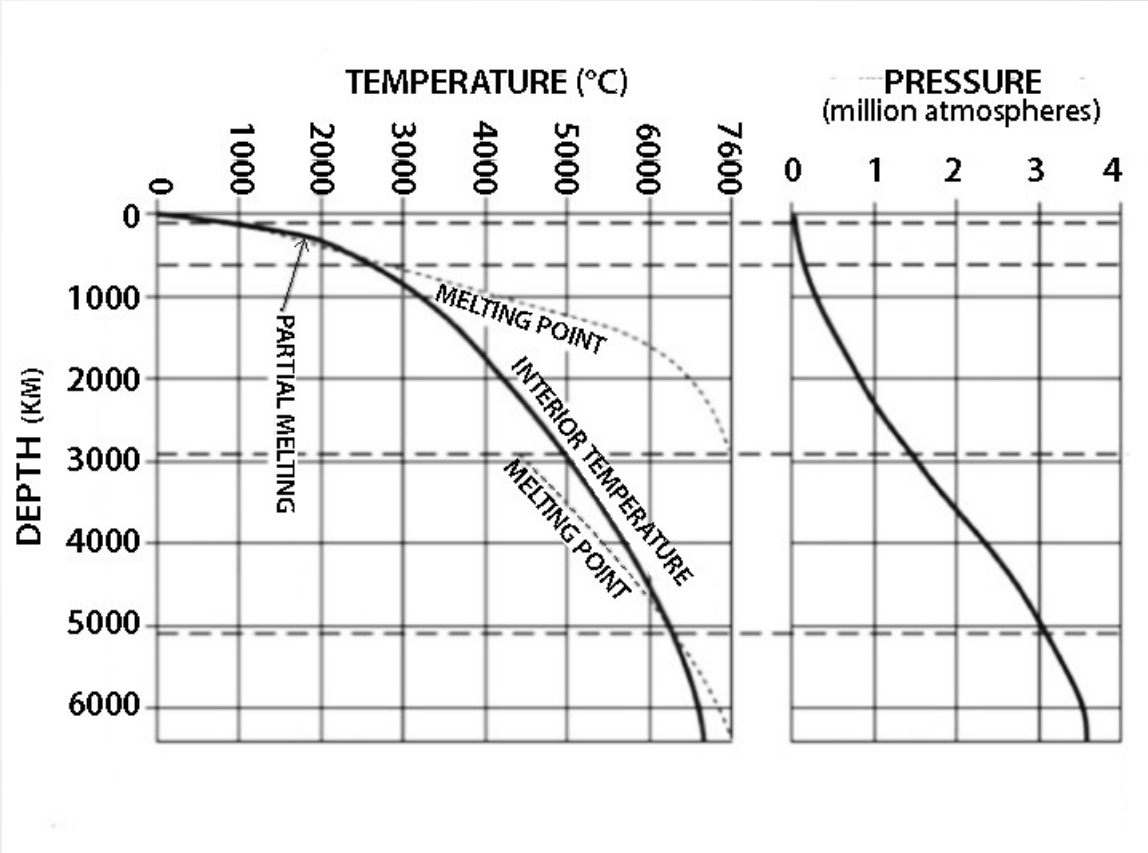

Full lesson plan and relevant resource links available from:

http://www.iris.edu/hq/inclass/lesson/70